

REMARKS

This document is submitted in reply to the Office Action dated February 26, 2009 (“Office Action”).

Applicants have amended claims 1 and 6 to more particularly point out the subject matter they deem as their invention. Support for the amendments appears in the Specification at page 3, line 3, and in original claims 3, 5, 8, and 9. These amendments have necessitated cancellation of claims 3, 5, and 8, which in turn has necessitated amendment of claim 9. Support for this amendment can be found in original claim 9. No new matter has been introduced.

Upon entry of the amendments, claims 1, 2, 4, 6, 7, and 9 will be pending and under examination. Applicants respectfully request that the Examiner reconsider this application in view of the following remarks.

Rejection under 35 U.S.C. § 112, 2nd paragraph

The Examiner rejects claim 1-5 as indefinite. See the Office Action, page 2, lines 6-10. As mentioned above, claims 3 and 5 have been cancelled. Claims 2 and 4 depend directly from claim 1.

In particular, the Examiner rejects claim 1 for its recitation of “up to 1050 or 1200°C,” which she believes makes it unclear if the temperature is inclusive of temperatures between 1050°C and 1200°C.

To promote clarity, Applicants have amended claim 1 to recite “to 1050°C to 1200°C.” In view of this amendment, a skilled artisan would understand that the recited range includes temperatures between 1050°C and 1200°C. As such, claim 1 is definite. So are claims 2 and 4, which depend from it.

Objections

The Examiner objects to claim 9 for informalities. In particular, she objects to the term “it” recited in this claim for being interpretable as referring to either “silica gel” or “a tube furnace.” See the Office Action, page 2, lines 12-15.

Claim 9 has been amended to remove this feature, which can now be found in amended claim 6. Claim 6 as amended, recites “silica gel” instead of the term “it”.

35 U.S.C. § 102 Rejections

The Examiner rejects both claims 1 and 6 for anticipation, relying on Kang et al., Korean Patent No. KR 0121427 (“Kang”), and Iler et al., US Patent No. 3,855,172 (“Iler I”), respectively. See the Office Action, page 3, lines 7-8, and lines 18-19.

Applicants first address the rejection of claim 1. This claim, as amended, covers a method for fabricating a porous silica sphere in which a silica gel is heat-treated in a rotary tube furnace. During heat-treatment, the temperature of the silica gel in the rotary tube furnace is increased at a speed of 5°C to 90°C per minute. In other words, the method of amended claim 1 features (i) use of a rotary tube furnace and (ii) use of a temperature increase speed of 5°C to 90°C per minute.

As correctly pointed out by the Examiner, Kang teaches “heat treating silica gel by increasing its temperature at a speed of less than 90°C per minute up to 1050°C to 1200°C [in a] alumina crucible [J]” and the temperature is increased at a “per hour heating [] speed of 120°C.” See the Office Action, page 3, lines 9-17. Given these teachings, it is clear that Kang’s method differs from the method of amended claim 1 in two ways: (1) it uses an alumina crucible, NOT a rotary tube furnace as in the method of claim 1, and (2) it uses a temperature increase speed of 2°C per minute, NOT a speed of 5°C to 90°C per minute as in the method of claim 1. Thus, Kang does not teach either using a rotary tube furnace or using a temperature increase speed of 5°C to 90°C per minute. Indeed, neither does it suggest so.

For the reasons set forth above, Applicants submit that Kang does not anticipate amended claim 1.

Turning to claim 6, this claim, as amended, covers a method for fabricating a porous silica sphere, which features the use of at least two rotary tube furnaces.

Iler I teaches that the silica gel is heated in air for 16-48 hours in a layer less than one inch in depth. See column 8, lines 25-27. Iler I also teaches that the silica gel

microspheres, being fragile, are readily crushed. See column 8, lines 28-29. In view of these teachings, it is clear that **rotation** is **not** required and, in fact, should be avoided lest the silica gel be crushed. As such, a skilled artisan would have understood that Iler I DOES NOT teach or suggest using a **rotary** tube furnace, let alone at least two **rotary** tube furnaces as in amended claim 6.

In view of these differences, Applicants submit that amended claim 6 is not anticipated by Iler I.

Rejection under 35 U.S.C. § 103

Claims 2-9 are rejected or obviousness on five grounds. Applicants address each ground separately below.

I

The Examiner rejects claim 2 for being obvious over Kang in view of Iler et al., U.S. Patent No. 4,105,426 ("Iler II"). Claim 2 depends from claim 1. Applicants therefore will address this rejection as if directed at amended claim 1.

As pointed out above, claim 1, as amended, covers a method for fabricating a porous silica sphere that features using of a **rotary tube furnace**.

As also pointed out above, Kang's method differs from the method of amended claim 1 in that it uses an alumina crucible, NOT a rotary tube furnace as in the method of claim 1. In other words, Kang does not suggest using a rotary tube furnace.

Turning to Iler II, this reference teaches a method for producing silica gel microspheres. See the Abstract. This reference also teaches that the microspheres are formed by the process disclosed in Iler I. See Column 1, lines 44-47. As mentioned above, the Iler I method DOES NOT suggest using a rotary tube furnace. As such, it is clear that neither Iler I nor Iler II suggests using a rotary tube furnace as featured in amended claim 1.

As neither Kang nor Iler II suggests using a rotary tube furnace as featured in claim 1, these references in combination, do not render claim 1 obvious. Nor do they render obvious claim 2, which depends from claim 1.

II

The Examiner rejects claims 3 and 4 as obvious over Kang. See the Office Action, page 5, lines 7-19. Claim 3 has been cancelled. Claim 4 depends from claim 1.

Claim 1, as amended, covers a method for fabricating a porous silica sphere that features using a **rotary tube furnace**. See the discussion above.

As also mentioned above, Kang fails to suggest using a rotary tube furnace. Also see the discussion above.

In view of the these facts, Applicants submit that claim 1 is not rendered obvious by Kang. Nor does this reference render obvious claim 4, which depends from claim 1.

III

The Examiner rejects claim 5 as obvious over Kang in view of Duraiswami et al., U.S. Patent No. 6,616,873 ("Duraiswami"). See the Office Action, page 5, line 20 through page 6, line 9.

Applicants have cancelled claim 5, thereby rendering this rejection moot.

IV

The Examiner rejects claim 7 as obvious over Iler I. See the Office Action, page 6, lines 12-19. Claim 7 depends from claim 6.

As discussed above, claim 6, as amended, covers a method for fabricating a porous silica sphere, which features the use of at least two rotary tube furnaces.

As also discussed above, Iler I does not suggest using a rotary tube furnace, let alone at least two rotary tube furnaces as featured in amended claim 6.

In view of the above facts, Applicants submit that claim 6 is not rendered obvious by Iler I. Nor does this reference render obvious claim 7, which depends from claim 6.

V

The Examiner rejects claim 8 and 9 as obvious over Iler I in view of Duraiswami. See the Office Action page 6, lines 20-22. Claim 8 has been cancelled. Claim 9 depends from claim 6.

As pointed out above, amended claim 6 covers a method for fabricating a porous silica sphere, which features the use of at least two rotary tube furnaces.

As also pointed out above, Iler I does not suggest using a rotary tube furnace, let alone at least two rotary tube furnaces as in amended claim 6.

Applicants now turn to Duraiswami. The Examiner correctly points out that Duraiswami teaches “heat treatment [] performed using a rotary tube furnace for the benefit of increasing porosity by providing even heating to all particles and preventing agglomeration.” See the Office Action, page 7, lines 4-6. In other words, Duraiswami teaches that using a rotary tube furnace would prevent particles from agglomerating together.

The Examiner proceeds to conclude that it would have been obvious to use the rotary tube furnace taught by Duraiswami in the Iler I method. See the Office Action, page 7, lines 6-10. Applicants disagree.

Applicants would like to point out that Iler I describes a method for producing a silica gel microsphere. In this method, the silica gel particles agglomerate (i.e., coacervate) into an array of colloidal silica particles, which are linked together to form the microsphere. See Fig. 1. The agglomeration of individual silica gel particles to form a microsphere is a vital step in the Iler I method. In addition, Iler I teaches that the silica gel microspheres, being fragile, are readily crushed. See column 8, lines 28-29.

The law is well established that “[i]f a proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification.” See MPEP § 2143.01. Modification of the prior art as proposed by the Examiner, i.e., use of a rotary tube furnace in the Iler I method, would result in prevention of the silica gel particles in the from agglomerating to form a microsphere. Moreover, its use would likely damage the porous microspheres as they are fragile. Clearly, “the proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose [i.e., forming silica gel microspheres by agglomeration].” Thus, contrary to the Examiner’s assertion, there would have been no suggestion or motivation to use the rotary tube furnace taught in Duraiswami in the Iler I method, thereby arriving at the method of claim 6.

For the reasons set forth above, amended claim 6 is not rendered obvious by Iler I in combination with Duraiswami. Nor do these references render obvious claim 9, which depends from claim 6.

VI

Even if a prima facie case of obviousness against claims 1 and 6 had been established based on Kang, Iler I, and Iler II, either alone or in combination, which Applicants do not concede, it can be successfully rebutted by a showing of unexpected results provided in the co-filed declaration by Sun-Uk Kim ("Declaration").

In Experiment I of the Declaration, Applicants used a non-rotary tube furnace during heat treatment of the silica gel. As shown in Figure 1, after heat treatment of the silica gel using the Kang method, part of silica gel was over-foamed and clumped after heat treatment. Over-foaming and clumping did not occur when a rotary tube furnace was used with a temperature increase speed of 5°C to 90°C per minute was used, i.e., following the method of claim 1. See the Specification, Examples 1-3 and Figure 3. Thus, the use of a rotary tube furnace in combination with a temperature increase speed of 5°C to 90°C per minute demonstrates the advantage of Applicants' method over the Kang method, in which these conditions are not used.

In Experiment II of the Declaration, Applicants used the temperature increase speed taught in Kang, i.e., 120°C/hour or 2 °C/min, in combination with the use of a non-rotary furnace, also taught in Kang. As can be seen in Figure 2, failure to use a rotary tube furnace resulted in incomplete heat into the silica gel due to the adiabatic effect of already-foamed silica gel spheres, which insulate the interior silica gel from reaching the appropriate temperature. As such, the interior silica gel fails to foam. Thus, the use of a rotary tube furnace demonstrates the advantage of Applicants' method versus the methods of Kang, Iler I, and Iler II, in which a rotary tube furnace is not used.

CONCLUSION

It is believed that all of the pending claims have been addressed. However, the absence of a reply to a specific rejection, issue or comment does not signify agreement

Applicant : Sun-Uk Kim et al.
Serial No. : 10/560,023
Filed : December 8, 2005
Page : 10 of 10

Attorney Docket No.: 76303-003US1
Client Ref. No.: OPP053249US

with or concession of that rejection, issue or comment. In addition, because the arguments made above may not be exhaustive, there may be reasons for patentability of any or all pending claims (or other claims) that have not been expressed. Finally, nothing in this paper should be construed as an intent to concede any issue with regard to any claim, except as specifically stated in this paper, and the amendment of any claim does not necessarily signify concession of unpatentability of the claim prior to its amendment.

The Petition for Extension of Time fee in the amount of \$130 is being paid concurrently herewith on the Electronic Filing System (EFS) by way of Deposit Account authorization. Please apply any other charges to Deposit Account No. 50-4189, referencing Attorney Docket No. 76303-003US1.

Respectfully submitted,

Date: 6-26-09


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